

WHAT IS CLAIMED IS:

1. A manufacturing method of a piezoelectric/electrostrictive film type device including a substrate of a ceramic, a piezoelectric/electrostrictive operation portion containing a lower electrode, a piezoelectric/electrostrictive layer, and a upper electrode being formed on said substrate, wherein the piezoelectric/electrostrictive layer is formed beyond at least one of the electrodes, thereby the ends of the layer is projected, wherein said method comprises the steps of:

forming the piezoelectric/electrostrictive layer of the piezoelectric/electrostrictive operation portion in a range broader than that of at least one of electrodes to project ends of the piezoelectric/electrostrictive layer;

coating a coating liquid prepared by admixing a polymerizable oligomer and inorganic particles in a dispersing medium in an amount sufficient to make the coating liquid permeate through a gap between at least a projecting portion of the piezoelectric/electrostrictive layer and the substrate and coat a predetermined portion of said at least one of electrodes electrode; and

drying the coating liquid to form a coupling member to couple ends of a projected portion of the piezoelectric/electrostrictive layer to the substrate.

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2. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 1,

comprising the steps of: applying the coating liquid using a  
coating apparatus comprising: pressurizing supply means for  
pressurizing/supplying the coating liquid; switching means  
which is disposed in a supply path of the pressurizing supply  
5 means to switch the supply of the coating liquid; and a  
discharge head for discharging the coating liquid introduced  
from the supply path of the pressurizing supply means to the  
outside, the discharge head comprising: a substrate including  
a coating liquid introduction path connected to the supply  
10 path of the pressurizing supply means, a pressurizing chamber  
in which the coating liquid introduction path opens, and one  
or more coating liquid discharge paths connected to the  
pressurizing chamber and opened to the outside; and a  
piezoelectric/electrostrictive operation portion disposed in  
15 a position opposite to the pressurizing chamber on the  
substrate, wherein at an open time of the switching means,  
the coating liquid introduced into the pressurizing chamber  
is continuously discharged in an atomized droplet state by  
flexural displacement of the piezoelectric/electrostrictive  
20 operation portion.

3. The manufacturing method of the piezoelectric/  
electrostrictive film type device according to claim 1,  
comprising the steps of: applying the coating liquid using a  
25 coating apparatus comprising: a substrate including a coating  
liquid introduction path connected to a coating liquid supply  
source, a pressurizing chamber in which the coating liquid

introduction path is opened, and one or more coating liquid discharge paths connected to the pressurizing chamber and opened to the outside; and a piezoelectric/electrostrictive operation portion disposed in a position opposite to the  
5 pressurizing chamber, wherein in accordance with flexural displacement of the piezoelectric/electrostrictive operation portion, the coating liquid introduced into the pressurizing chamber is discharged in an atomized droplet state.

10           4. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 2, comprising the steps of: applying the coating liquid in an amount which differs with a position to be applied using any one of a coating apparatus comprising a discharge head  
15 including a plurality of coating liquid discharge paths having different nozzle sizes, and a coating apparatus comprising a plurality of discharge heads different from one another in the nozzle size of the coating liquid discharge path.

20           5. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 3, comprising the steps of: applying the coating liquid in an amount which differs with a position to be applied using a  
25 coating apparatus comprising a plurality of coating liquid discharge paths having different nozzle sizes.

6. The manufacturing method of the piezoelectric/  
electrostrictive film type device according to claim 1,  
comprising the steps of: applying the coating liquid while  
vibrating at least the substrate or the piezoelectric/  
5 electrostrictive layer.

7. The manufacturing method of a piezoelectric/  
electrostrictive film type device according to claim 1,  
wherein the piezoelectric/electrostrictive operation portion  
10 is a multilayered structure.

8. The manufacturing method of the piezoelectric/  
electrostrictive film type device according to claim 7,  
comprising the steps of: applying the coating liquid using a  
15 coating apparatus comprising: pressurizing supply means for  
pressurizing/supplying the coating liquid; switching means  
which is disposed in a supply path of the pressurizing supply  
means to switch the supply of the coating liquid; and a  
discharge head for discharging the coating liquid introduced  
20 from the supply path of the pressurizing supply means to the  
outside, the discharge head comprising: a substrate including  
a coating liquid introduction path connected to the supply  
path of the pressurizing supply means, a pressurizing chamber  
in which the coating liquid introduction path opens, and one  
25 or more coating liquid discharge paths connected to the  
pressurizing chamber and opened to the outside; and a  
piezoelectric/electrostrictive operation portion disposed in

a position opposite to the pressurizing chamber on the substrate, wherein at an open time of the switching means, the coating liquid introduced into the pressurizing chamber is continuously discharged in an atomized droplet state by  
5 flexural displacement of the piezoelectric/electrostrictive operation portion.

9. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 7,  
10 comprising the steps of: applying the coating liquid using a coating apparatus comprising: a substrate including a coating liquid introduction path connected to a coating liquid supply source, a pressurizing chamber in which the coating liquid introduction path is opened, and one or more coating liquid discharge paths connected to the pressurizing chamber and opened to the outside; and a piezoelectric/electrostrictive operation portion disposed in a position opposite to the pressurizing chamber, wherein in accordance with flexural displacement of the piezoelectric/electrostrictive operation  
15 portion, the coating liquid introduced into the pressurizing chamber is discharged in an atomized droplet state.  
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10. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 8,  
25 comprising the steps of: applying the coating liquid in an amount which differs with a position to be applied using any one of the coating apparatus comprising a discharge head

including a plurality of coating liquid discharge paths having different nozzle sizes, and a coating apparatus comprising a plurality of discharge heads different from one another in the nozzle size of the coating liquid discharge path.

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11. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 9, comprising the steps of: applying the coating liquid in an amount which differs with a position to be applied using a coating apparatus comprising a plurality of coating liquid discharge paths having different nozzle sizes.

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12. The manufacturing method of the piezoelectric/electrostrictive film type device according to claim 7, comprising the steps of: applying the coating liquid while vibrating at least the substrate or the piezoelectric/electrostrictive layer.